Narrative

15 February 2001

Expanded Two Dimensional Flow Analysis (RMA-2) Model

Lockwood Greene has reviewed multiple RMA-2 models produced by FEMA and USGS. The review of these models indicated that the models did not represent existing land conditions; therefore, a completely new RMA-2 model was created by Exponent Incorporated, based on the latest digital topography, digital aerial photography, and the most complete and accurate information available. This exhaustive RMA-2 model (Exponent) is without doubt the most correct RMA-2 produced to date for the Congaree River.

The HEC-2 method to calculate flood elevations in a wide floodplain provides significant error and is the reason why the USGS selected the RMA-2/TABS model to study this portion of the Congaree River for the proposed I-77 construction. Regardless of FEMA's regulations requiring levee-in and levee-out HEC-2 calculations, a flood through the Congaree River will only react in one unique way. The Exponent RMA-2 model is the best-suited and the most mathematically correct model to predict what will actually occur during a flood. The Exponent RMA-2 model indicates that a small amount of flow does occur behind the levee based on a worse case breach scenario, but the quantity and continuity of flow does ***not*** allow for floodway on the levee interior.

USGS Narrative and RMA-2 Model of the Congaree River

The USGS RMA-2 model had similar errors to the FEMA model and in fact had similar results. Both models excluded two downstream levees that encircle on each other to form a closed loop, and both models found very little flow behind the levee and a very limited area where velocity exceeds 1 foot per second. The USGS RMA-2 model indicated less then 9% of the total flow interior to the levee even with incorrect topographic information. Once correct topographic information is added to the USGS and FEMA models the percent of flow will be reduced to the amount indicated in the Exponent RMA-2 model in this submittal. Models prepared by USGS and FEMA do ***not*** allow for floodway on the levee interior considering the quantity and continuity (continuous flow path) of flow.

High Water Marks of the Congaree River

High water marks from the flood of 1976 from Carolina-Eastman were added to the high water marks presented by FEMA and a comparison made. The comparison indicated that FEMA had placed the high water mark at Location 7 incorrectly.

The FEMA prepared HEC-2 finalhgh.dat (levee-out) greatly underestimated high water marks of the 1976 flood. This does ***not*** meet FEMA 37 guidelines, but FEMA justified its usage by stating incorrectly that the levee is overtopped by flows greater than 200,000 cfs. In fact, the levee is not overtopped anywhere along the Congaree River based on the latest FEMA Lexington County HEC-2 model.

Corrected high water marks were compared to FEMA's calibration HEC-2 model finallow.dat (levee-in) and indicated a good match in the upper reach of the Congaree River. The HEC-2 model finallow.dat in the lower reach (south of Gills Creek) over estimated the water surface elevation. In summary, the 1976 high water marks closely match the FEMA prepared HEC-2 calibration model finallow.dat (levee-in), which is the base model used to determine Lexington County Base Flood Elevation. The Lexington County HEC-2 model (levee-in) matches observed high waters more closely than any other model prepared by FEMA.

HEC-2 Computations

In an effort to create a HEC-2 model by replicating the more accurate RMA-2 model results, a base HEC-2 model must be selected. It is reasonable to use the model that most closely matches the observed high water marks considering that the levee is ***not*** overtopped by flows of 292,000 cfs and closely matches the new Exponent RMA-2. It is obvious that the HEC-2 calibration model finallow.dat (levee-in) should be used as the basis for the unique model that matches actual conditions.

In the new HEC-2 model generated as part of this report, the floodplain and floodway stay within the boundaries of the FEMA 26 September 2000 mapping, and this HEC-2 model also removes floodway from the levee interior. This is consistent with the Exponent RMA-2 model submitted in this report.